Work through the following problems, show your tutor then record your name before the end of your Week 5 tutorial. You are encouraged to discuss these questions and your solutions with your peers and to ask your tutor for assistance. Working through ten sets of tutorial problems is compulsory and each of the ten problem sets will contribute 1% towards your final grade. Note that you earn the 1% for your effort in solving these problems during the tutorial rather than for answering all the problems correctly.

Once you have finished these problems, you can use the remainder of your tutorial time to work on other aspects of the course. Solutions to the tutorial problems will be distributed next week.

1. Let \( \mathbf{a} = \begin{pmatrix} 3 \\ -2 \\ 5 \end{pmatrix} \).
   a) Determine the norm of \( \mathbf{a} \).
   b) Determine the matrix form of the unit vector \( \hat{\mathbf{a}} \).

2. Write the following 2-space vectors in component and matrix form:
   a) vector \( \mathbf{v} \) has magnitude 2 and direction \( \frac{5\pi}{6} \).
   b) vector \( \mathbf{w} \) has magnitude 4 and direction \( \frac{5\pi}{3} \).

3. Find the magnitude and direction (in both degrees and radians) of the following vectors:
   a) \( \mathbf{v} = -i - \sqrt{3}j \)
   b) \( \mathbf{w} = -4i + 2j \)

Please turn over.
4. Let $ABCD$ be a rectangle with $P$ the midpoint of the line segment $AC$ as shown. Let $\overrightarrow{AD} = u$ and let $\overrightarrow{AB} = v$.

![Diagram of a rectangle with vectors]

a) Express $\overrightarrow{AP}$ in terms of $u$ and $v$.

b) Express $\overrightarrow{BP}$ in terms of $u$ and $v$.

c) Express $\overrightarrow{PD}$ in terms of $u$ and $v$.

d) Use the above calculations to show that the diagonals of a rectangle bisect each other.

5. A force of 24N is exerted on an object at an angle of 60° upwards from the horizontal. If another force of 16N in the same plane is applied at an angle of 30° upwards from the horizontal, what is the resultant force acting on the object?